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1.1 Data structures

Data structures

A ***data structure*** is a way of organizing, storing, and performing operations on data. Operations performed on a data structure include accessing or updating stored data, searching for specific data, inserting new data, and removing data. The following provides a list of basic data structures.

Table 1.1.1: Basic data structures.

Data structure	Description
Record	A ***record*** is the data structure that stores subitems, often called fields, with a name associated with each subitem.
Array	An ***array*** is a data structure that stores an ordered list of items, where each item is directly accessible by a positional index.
Linked list	A ***linked list*** is a data structure that stores an ordered list of items in nodes, where each node stores data and has a pointer to the next node.
Binary tree	A ***binary tree*** is a data structure in which each node stores data and has up to two children, known as a left child and a right child.
Hash table	A ***hash table*** is a data structure that stores unordered items by mapping (or hashing) each item to a location in an array.
Heap	A ***max-heap*** is a tree that maintains the simple property that a node's key is greater than or equal to the node's childrens' keys. A ***min-heap*** is a tree that maintains the simple property that a node's key is less than or equal to the node's childrens' keys.

Graph	A ***graph*** is a data structure for representing connections among items, and consists of vertices connected by edges. A ***vertex*** represents an item in a graph. An ***edge*** represents a connection between two vertices in a graph.

Feedback?

PARTICIPATION ACTIVITY 1.1.1: Basic data structures.

1) A linked list stores items in an unspecified order.
   - True
   - False

2) A node in binary tree can have zero, one, or two children.
   - True
   - False

3) A list node's data can store a record with multiple subitems.
   - True
   - False

4) Items stored in an array can be accessed using a positional index.
   - True
   - False

Feedback?

Choosing data structures

The selection of data structures used in a program depends on both the type of data being stored and the operations the program may need to perform on that data. Choosing the best data structure often requires determining which data structure provides a good balance given expected uses. Ex: If a program requires fast insertion of new data, a linked list may be a better choice than an array.

PARTICIPATION ACTIVITY 1.1.2: A linked list avoids the shifting problem.

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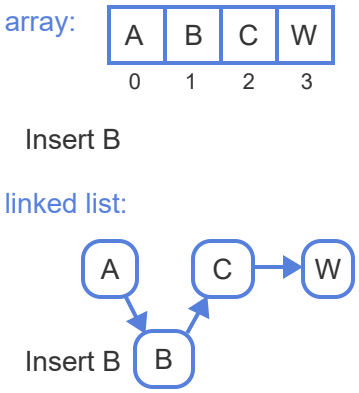

Captions

1. Inserting an item at a specific location in an array requires making room for the item by shifting higher-indexed items.
2. Once the higher index items have been shifted, the new item can be inserted at the desired index.
3. To insert new item in a linked list, a list node for the new item is first created.
4. Item B's next pointer is assigned to point to item C. Item A's next pointer is updated to point to item B. No shifting of other items was required.

Feedback?

PARTICIPATION ACTIVITY 1.1.3: Basic data structures.

1) Inserting an item at the end of a 999-item array requires how many items to be shifted?

Check Show answer

2) Inserting an item at the end of a 999-item linked list requires how many items to be shifted?

Check Show answer

3) Inserting an item at the beginning of a 999-item array requires how many items to be shifted?

Check Show answer

4) Inserting an item at the beginning of a 999-item linked list requires how many items to be shifted?

Check Show answer

Feedback?

How was this section? Provide section feedback